HIGHLIGHTS ARCHIVE

NASA SimLabs News

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1. Generic Airspace Evaluation Phase 4 Completed

Ames' Human Systems Integration Division researchers successfully completed a simulation that evaluated methods for providing important airspace information and automation tools so that less training and memorization are required to manage air traffic in mid-term, Next Generation Air Transportation System (NextGen) airspace. Phase 4 of the Generic Airspace Project was focused on testing generic sectors in off-nominal conditions. Also, there was interest in discovering how one of the aspects of the FAA's Mid-term, High Altitude Airspace Concept might work in generic sectors.

The NASA SimLabs' Crew-Vehicle Systems Research Facility Air Traffic Control Laboratory was used for this study. It employs the Multi Aircraft Control System (MACS) to realistically emulate the FAA's en route air traffic control Display System Replacement user interface. MACS was configured to provide several NextGen automation tools including datacomm, conflict probe, and manual conflict resolution.

The study involved four controller participants and several simulation pilots (who supported the simulation). Upon arriving, the controller participants received a briefing and hands-on practice with the automation tools. They were also provided with practice in the airspace using the Controller Information Tool, which displayed essential sector data. Each participant was then presented with a series of traffic scenarios in the MACS simulator. Data collection runs included six test conditions (baseline, weather, extra traffic, and three mixed equipage scenarios). Data from the simulation are now being analyzed.

ATC Lab Generic Airspace Simulation

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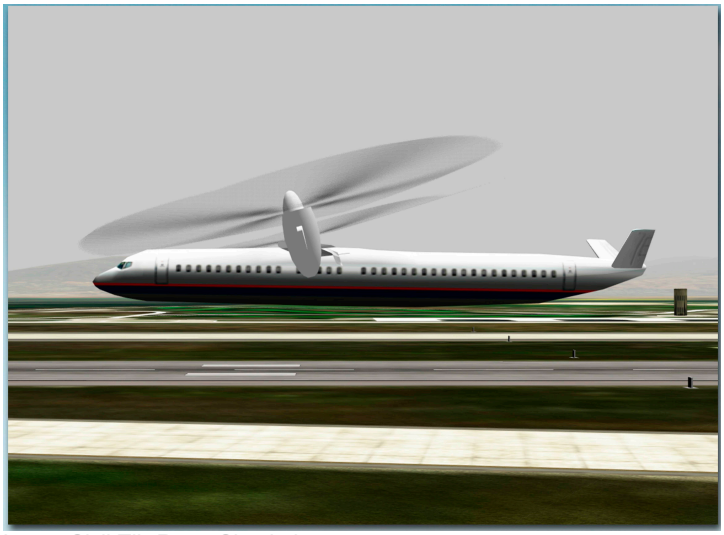
2. Large Civil Tilt-Rotor (LCTR) Handling Qualities Evaluation on the Vertical Motion Simulator



Large Civil Tilt-Rotor Simulation

A four-week long, joint NASA/Army simulation on the VMS investigated hover and low-speed handling qualities and control requirements for a Large Civil Tilt-Rotor (similar in size to a Boeing 737). The primary objective of this effort was to investigate the use of Translational Rate Command (TRC) for control in the hover and low-speed flight regime for this type of aircraft. The motivation came from two previous LCTR simulations conducted at the VMS. The first experiment exposed some fundamental handling qualities issues related to the size of the aircraft, which is larger than any currently flying helicopter or tilt-rotor. The second experiment investigated the effect of pilot offset from the center of gravity on handling qualities and indicated that satisfactory handling qualities could not be obtained in the low speed range with an Attitude Command/Attitude Hold (ACAH) system.

Flight Deck of the LCTR

For the latest experiment, an enhanced stability derivative math model was developed to simulate the LCTR with fully moveable nacelles and a valid flight envelope up to 60 knots. ACAH, TRC, and mixed ACAH/TRC control response modes were tested together with different TRC inception approaches: via the center stick, via a proportional thumb controller located on the Thrust Control Lever (TCL), and combinations of the two. Ten experimental test pilots from NASA, the U.S. Army, U.S. Marine Corps, Bell Helicopter, Boeing, and Sikorsky evaluated the handling qualities of the LCTR with the different control modes and TRC inception methods for well-defined hover and low-speed maneuvers over a simulated Moffett Field visual database. All pilots evaluated the complete test matrix of flight control modes and inceptor configurations. In addition, time permitted some in-depth supplementary explorations of different

nacelle rate limits and a control system improvement that minimized rotor flapping in response to nacelle motions.

Preliminary results showed that the TRC generally improved the handling qualities, but a wide range of piloting techniques exposed handling qualities deficiencies that warranted improvement. The research team was able to quickly respond to these findings and implement modifications to the flight control system that improved handling qualities. The results also showed that TRC reduced pilot workload and increased precision with Level 1 handling qualities being attained in the hover and low-speed maneuvers tested. The pilots were impressed with the realism of the simulation, and the researchers commented that it resulted in a “fascinating discovery…of Tilt-Rotor control issues.”

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3. Space Shuttle Landing and Rollout Training

Space Shuttle

The second Space Shuttle astronaut training session for 2010 was completed recently on the Vertical Motion Simulator (VMS). This periodic training familiarizes Shuttle crews with vehicle handling during approach, landing, and rollout under normal operating conditions, as well as off-nominal and failure conditions. Over the one-week training session, 15 pilots and 10 mission specialists completed 172 training runs. Crews for the final five Space Shuttle missions, (STS-130, STS-131, STS-132, STS-133, and STS-134) were included in the training. The commanders for STS-130, STS-132, and the pilot for STS-131 re-lived their landings in the simulator under the same conditions experienced during their flights. They also got to explore different “what if” scenarios such as landing at the opposite end of the runway with different landing configurations. These post-mission simulations on the VMS provide important data on the effectiveness of the training and help refine approach and landing procedures. The astronaut office complimented the VMS staff on another successful training session.

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4. NASA Administrator Charles Bolden Visits the VMS


NASA Administrator Charles Bolden flying the LCTR on the VMS

NASA Administrator Charles Bolden, accompanied by Associate Administrator for Aeronautics Dr. Jaiwon Shin, visited the VMS to fly the Large Civil Tilt-Rotor (LCTR) simulation. During the demonstration, Mr. Bolden flew a precision hover task with the two control system configurations (an attitude command system and a translational rate command system) that were evaluated during the LCTR experiment. Mr. Bolden also flew the aborted departure maneuver task where he started in a hover, had to accelerate to 40 knots, and then stop before reaching a distance threshold. Mr. Bolden and Dr. Shin were at Ames attending the Green Aviation Summit where Mr. Bolden gave the opening keynote address. In his opening address, Mr. Bolden stated, “It was thrilling to get over to the VMS and have an opportunity to fly a tilt-rotor…Tilt-rotor aviation is going to revolutionize a lot of the things we do.”

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5. Thinking of Doing Business with NASA SimLabs

For more information on what we can do for your needs, contact:

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